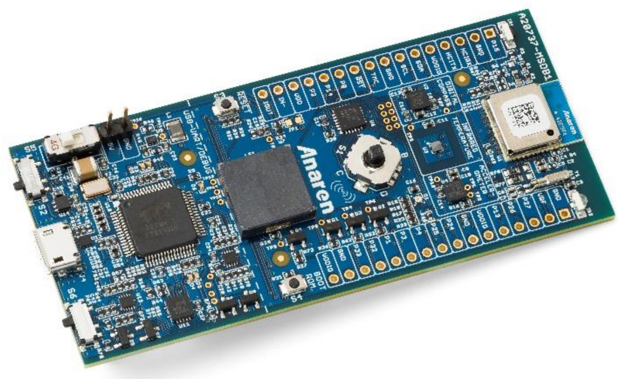
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What'll we think of next?®



Anaren Integrated Radio

Multi-Sensor Development Kit User's Manual

A20737-MSDK1

Release Date: 1/16/2015

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CONTENTS

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1. Multi-Sensor Development Kit

The *Bluetooth*® Smart Multi-Sensor Development Kit includes the following:

- One Multi-Sensor Development Board (MSDB) with Anaren AIR A20737A module installed
- One USB 2.0 cable (Type A to Mini-B)
- Two 16-pin headers that may be soldered on to the Multi-Sensor Development Board.
- Quick Start Guide
- Regulatory Guide

1.1. Multi-Sensor Development Board Overview

The Multi-Sensor Development Board (referred to as MSDB in the remainder of this document) provides a development environment to quickly build and demonstrate applications for the A20737x AIR module. It provides onboard sensors and controls that allow development engineers to quickly put together and demonstrate prototypes. The board includes the following features:

- Digital compass
- Infra-red temperature sensor
- Accelerometer
- Five-way switch (joystick)
- Buzzer
- Infra-red emitter and sensor
- Multi-colored LED

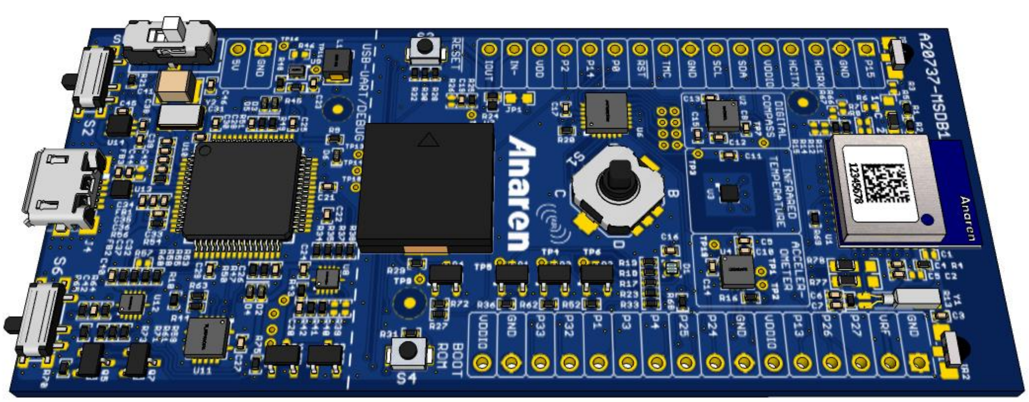


Figure 1 – Multi-Sensor Development Board Overview

2. Getting Started with the MSDB

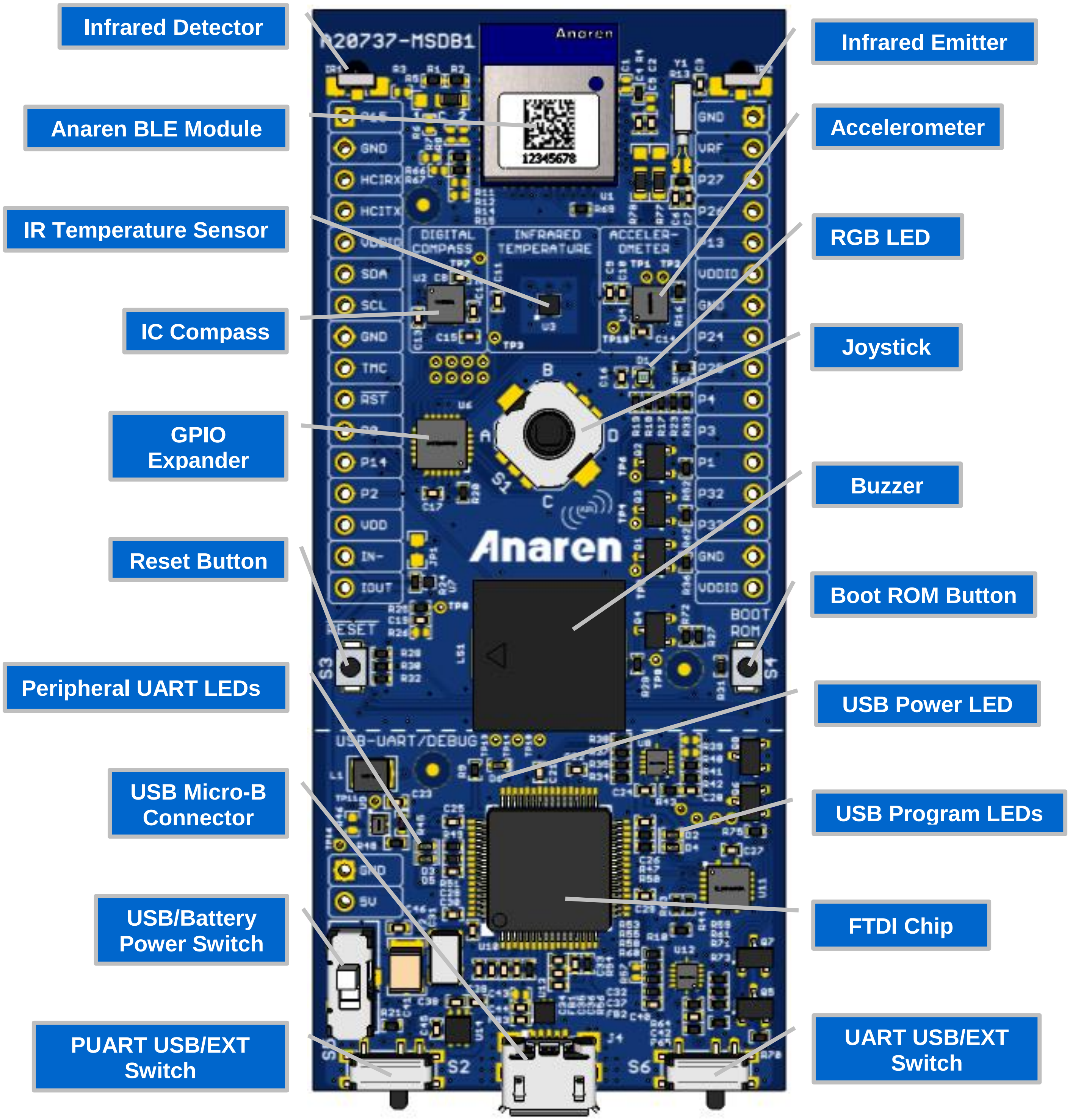


Figure 2 – Multi-Sensor Development Board (Front – Component Side)

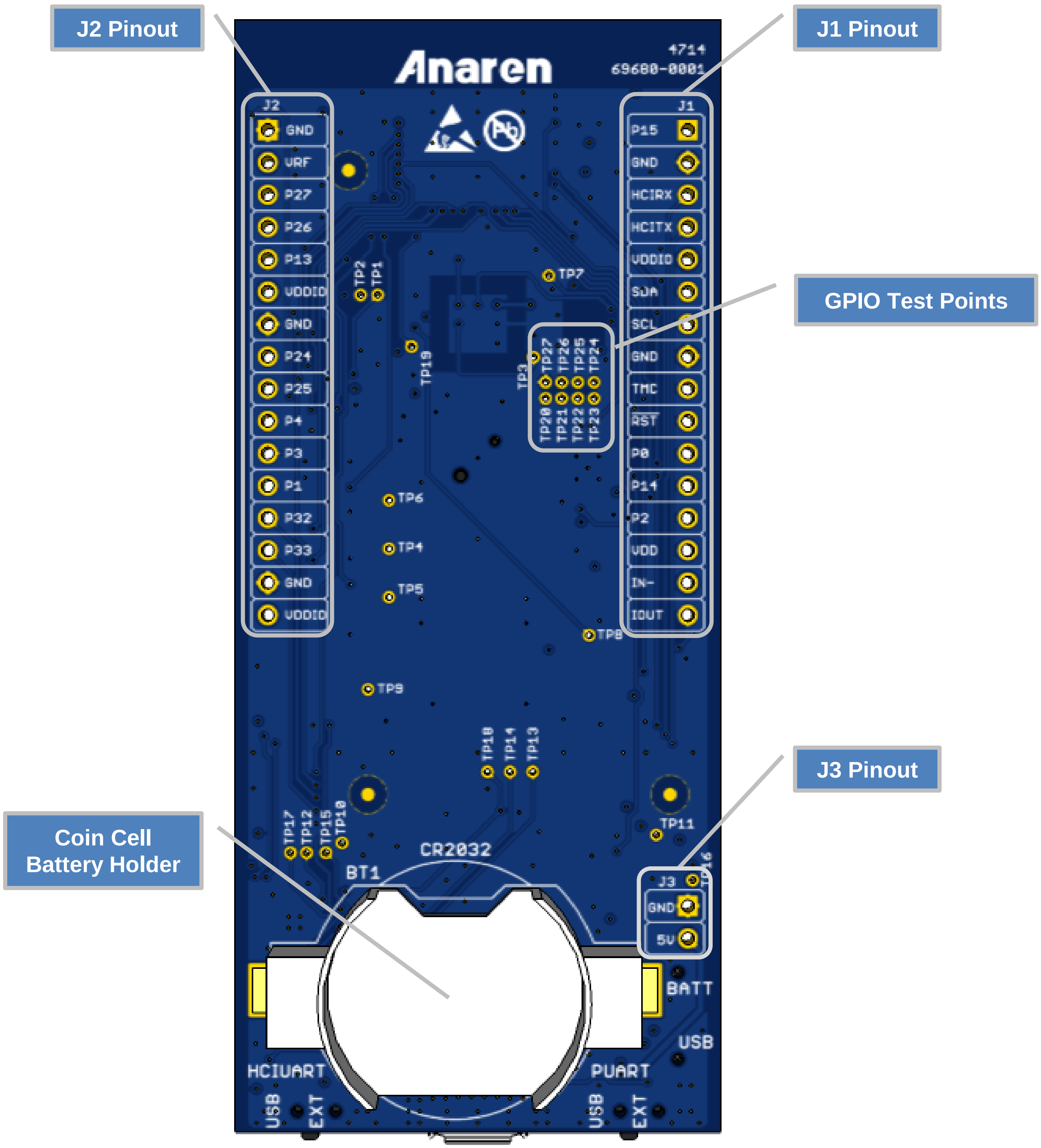


Figure 3 – Multi-Sensor Development Board (Back – Wire Side)

2.1. Anaren Atmosphere Wiki

The best place to start learning about how to use the MSDB with your mobile device is to visit the Anaren Atmosphere Wiki (https://atmosphere.anaren.com/wiki). However, the following sections also provide step by step instructions to guide you through the process.

2.2. Getting the Demo App

- **Apple iOS Devices**

  Go to the Apple App Store and search for "Anaren Atmosphere". Download and install it on your device.

- **Android Devices**

  Go to the Google Play Store and search for "Anaren Atmosphere". Download and install it on your device.

2.3. Using the Demo App

2.3.1. Hardware Setup

The MSDB comes preloaded with the Demo Application firmware and all switches are in the correct state. All that is needed is power. Using the provided USB micro-B cable, connect the MSDB to a PC/laptop (or USB battery).

2.3.2. Establishing a Wireless Connection

1) On your mobile device, run the Atmosphere App that was installed earlier.

2) Click the Demo button on the Atmosphere App (no need to login).

3) You should now see the compass and other controls & monitors the demo provides.

4) Click on the Gear Icon in the lower right corner. This will put you in the "Scanning Window".

5) Click on the scan button at the bottom. You should now see the board show up as ATDemo.

6) Click on the AT Demo board. It will become highlighted in blue.

7) Click on the connect button at the bottom. The App should connect, discover, and then go back to the original demo screen.

Your mobile device is now connected to the MSDB. It is actively monitoring the board status and controlling some of its operation.

2.3.3. Controlling/Monitoring the MSDB

Now that your mobile device is connected to the MSDB board, you can observe and do several things. In the demo application, the mobile device polls the MSDB for its status on a regular interval. So the monitored readings should respond fairly quickly (but not instantaneously). Try the following:

1) The board's IR Temperature Sensor should be reporting its temperature readings. Try holding your hand over the board and you should see the temperature go up. Remove your hand and it should go down. Note that you do not have to touch the temperature sensor.

2) The Accelerometer should be reporting the tilt of the board by moving the blue bubble in the gray box. Try tilting to the board in different directions. The bubble should move around inside the gray box in the same direction the board is being tilted.

3) The Compass should be showing your magnetic heading. Note that this is very sensitive, and as such does not always read correctly when in the presence of magnetic materials or strong magnetic fields. Be sure to hold the board horizontal to get the best compass reading.

4) The Joystick image should reflect the position of the joystick. Try moving the joystick and hold it in a new position and observe the image. Pressing the joystick in the center position (into the board) will play a tone on the buzzer.

5) The Red, Green and Blue sliders control the color and brightness of the RGB LED on the MSDB. Try moving them and observing the LED.

6) If you connected a terminal emulator to the USB COM port, then you should see some status information on the terminal screen flowing as well. This shows the PUART port operating properly. The meaning of the data is not important. The flow is what you're looking for. Ensure the PUART switch (S2) is set to the USB position (default).

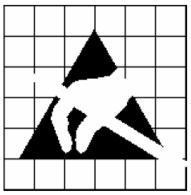
That's it. You have now verified that you can communicate with, control, and monitor the MSDB components using the Atmosphere Demo App. Please visit the Anaren Atmosphere Wiki (https://atmosphere.anaren.com/wiki) to find out how to develop your own custom embedded and mobile Apps.

3. Multi-Sensor Development Board Hardware

3.1. Electrical Characteristics

3.1.1. Absolute Maximum Ratings

Under no circumstances shall the absolute maximum ratings given in *Table 1* be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.



Caution!
ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

Table 1 – Absolute Maximum Ratings

Parameter	Min	Max	Unit	Condition
Supply Voltage on 5V_USB	-0.3	7.0	V	
Supply Voltage on VCOIN	-0.3	3.6	V	
Supply Voltage on VDD	-0.3	3.6	V	
Supply Voltage on VDDIO	-0.3	3.6	V	
Supply Voltage on VDD_RF	TBD	1.4	V	
Voltage on Any Digital Pin	-0.3	VDDIO + 0.3	V	
Input RF Level		-10	dBm	
Storage Temperature Range	-20	+80	°C	Unbiased (power not applied to any supply rail)
ESD		2000	V	According to JEDEC STD 22, method A114, Human Body Model (HBM)
		500	V	According to JEDEC STD 22, C101C,Charged Device Model (CDM)

3.1.2. Recommended Operating Conditions

Table 2 and *Table 3* show the allowed temperature range and voltages under which the MSDB may be operated.

Table 2 – Recommended Operating Conditions

Parameter	Min	Max	Unit	Condition
Supply Voltage on 5V_USB	3.6	6.5	V	
Supply Voltage on VCOIN	2.2	3.6	V	
Supply Voltage on VDD	2.2	3.6	V	
Supply Voltage on VDDIO	2.2	3.6	V	
Supply Voltage on VDD_RF	1.14	1.26	V	
Operating Temperature	-20	+70	°C	By design only. Not tested.

Table 3 – Digital I/O Characteristics (Signals on J1 & J2)

Parameter	Min	Max	Unit	Condition
V_{IL}	0	0.4	V	2.2V < VDDIO < 3.6V
V_{IH}	0.8 x VDDIO	VDDIO	V	2.2V < VDDIO < 3.6V
V_{OL}	-	0.4	V	2.2V < VDDIO < 3.6V
V_{OH}	VDDIO – 0.4	-	V	2.2V < VDDIO < 3.6V

3.2. Functional Description

A block diagram of the MSDB hardware is shown in *Figure 4*.

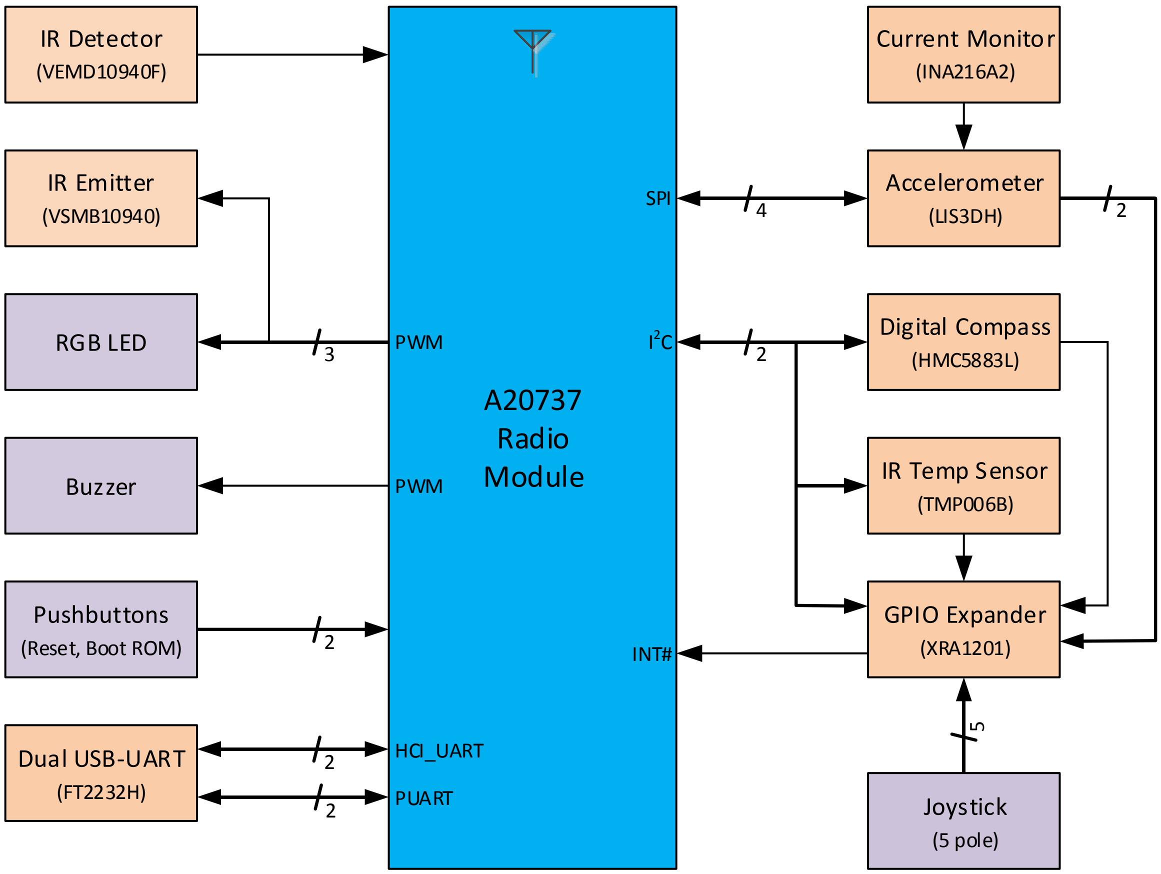


Figure 4 – Hardware Block Diagram

3.2.1. A20737 Radio Module (U1)

The Anaren *Bluetooth* Smart module uses the Broadcom BCM20737 System on Chip (SoC). The module provides all the required power supply filtering and decoupling, as well as an integrated PCB trace antenna and RF matching network. Interfaces for connecting external components include analog (10-bit ADC), GPIO, PWM, I^2C, SPI, and UART.

3.2.2. Sensors

- **Accelerometer (U4)**

  The ST Microelectronics LIS3DHTR 3-Axis Accelerometer (SPI) is used to sense acceleration in all directions (including gravity). This device has an embedded microcontroller that has motion-recognition capabilities such as free-fall detection and click/double click recognition. It also offers 3 auxiliary ADC channels. Please refer to the LIS3DHTR datasheet on the ST website for further info regarding this device.

- **Digital Compass (U2)**

  The Honeywell HMC5883L 3-Axis Digital Compass (I^2C) is used for low-field magnetic sensing in applications such as compassing and magnetometry. It can measure both the direction and the magnitude of Earth's magnetic fields. Please refer to the HMC5883L datasheet on the Honeywell website for further info regarding this device.

  The I^2C bus address of this device is 0x1E.

- **IR Temperature Sensor (U3)**

  The Texas Instruments TMP006B Infrared Thermopile Sensor (I^2C) measures the temperature of an object without the need to make contact with the object (-40C to +125C range). Please refer to the TMP006 datasheet on the TI website for further info regarding this device.

  The I^2C bus address of this device is 0x40.

- **Current Sense Amplifier (U7)**

  The Texas Instruments INA216A2 Current Shunt Monitor (analog) amplifies the voltage across a current sense resistor with a gain of 50. Please refer to the INA216 datasheet on the TI website for further info regarding this device.

  The sensor's analog output is routed to J1-16 where it can be sampled using an oscilloscope to see changes in load current in real-time. A filtered version of this signal is routed to the accelerometer's ADC2 input such that average current can be read by the A20737. To calculate current flowing through the 0.2Ω sense resistor, simply divide the measured voltage by 10 (Ishunt = Vshunt / Rshunt, where Rshunt = 0.2Ω and Vshunt = Vmeas / 50).

  Please note that with a 0.2Ω sense resistor, this amplifier is not intended to accurately measure sleep current. It is better suited for the higher Tx and Rx currents.

- **Infrared Emitter (IR2)**

  The Vishay VSMB10940 is an infrared 940nm side-looking emitting GaAlAs diode. On the MSDB, it is driven by the same FET that drives the blue segment of the RGB LED. Please refer to the VSMB10940 datasheet on the Vishay website for further info regarding this component.

- **Infrared Detector (IR1)**

  The Vishay VEMD10940F is a side-looking high-speed and high-sensitivity PIN photodiode with a daylight blocking filter matched to IR emitters in the 830nm to 950nm range. Please refer to the VEMD10940F datasheet on the Vishay website for further info regarding this component.

3.2.3. Switches

- **Joystick (S1)**

  The Joystick is a multi-directional switch with five positions; 'UP' (B), 'DOWN' (C), 'RIGHT' (A), 'LEFT' (D) and 'CENTER'. It connects to the onboard I^2C GPIO Expander device. See section 0 for more details regarding the GPIO Expander and how to generate an interrupt when the Joystick is pressed.

- **Reset Button (S3)**

  The Reset button is used to issue a hardware reset to the A20737 module. Press it momentarily to reboot the A20737.

- **Boot ROM Button (S4)**

  The Boot ROM button is used to recover the A20737 from a situation where the module's EEPROM becomes corrupted. This button forces the I^2C SDA line to VDDIO which prevents the processor from booting from EEPROM (only boots from ROM).

- **USB/Battery Power Switch (S5)**

  This switch selects the MSDB power source. In most development circumstances the board will be powered by the USB cable, but it may be powered by the CR2032 coin cell battery located on the back of the board instead. The board may also be powered by applying a supply voltage to the VDD pin on J1-14.

  - USB: Select this position when board is powered from +5V (USB or J3)
  - Battery: Select this position when board is powered from the battery or VDD

  Caution: Remove the coin cell battery when applying a voltage to VDD. Failure to do so may cause the battery to explode, which may result in damage to the MSDB and/or personal injury.

- **HCI UART Switch (S6)**

  This switch controls the connection of the HCI UART signals between the USB to Dual UART Bridge and the A20737 module. This is accomplished by controlling one of the supply voltages and the output enable of a dual supply bidirectional level shifter device. When the switch is set to 'USB' the level shifter is powered and its output is enabled, making the connection between the UART Bridge and the A20737 module. With the switch set to 'EXT' one side of the level shifter is powered down and the output is disabled, breaking the HCI UART connection by placing the signals in a high impedance state (not physically disconnected).

  - USB: Select this position for programming the A20737 module.
  - EXT: Select this position to run the loaded application following power-up or reset.

- **Peripheral UART Switch (S2)**

  This switch controls the connection of the peripheral UART signals between the USB to Dual UART Bridge and the A20737 module. This is accomplished by controlling one of the supply voltages and the output enable of a dual supply bidirectional level shifter device. When the switch is set to 'USB' the level shifter is powered and its output is enabled, making the connection between the UART Bridge and the A20737 module. With the switch set to 'EXT' one side of the level shifter is powered down and the output is disabled, breaking the PUART connection by placing the signals in a high impedance state (not physically disconnected). This allows an external device to be connected to the PUART signals on the J2 connector (pins 13 & 14 without flow control, pins 11 thru 14 with flow control).

  - USB: Select this position to use the USB to Dual UART Bridge for PUART communication.
  - EXT: Select this position to use an external device for PUART communication.

  Please note that an external device should not be connected to J2 while this switch is set to 'USB'. Doing so may damage the MSDB and/or the external device.

3.2.4. Indicators

- **RGB LED (D1)**

  The RGB LED can display red, green, blue, or just about any mixture of the three colors. Each LED segment is driven by a FET and controlled by GPIO or PWM (PWM is required to achieve color mixing beyond the 7 color combinations possible using GPIO). The LED controls are active-high (i.e. a logic '1' turns ON the LED, while a '0' turns it OFF). The LED segments are connected to the following ports on the A20737 module:

  - Red: P26 (PWM0)
  - Green: P27 (PWM1)
  - Blue: P13 (PWM3)

- **HCI UART LEDs (D2, D4)**

  These LEDs indicate activity on the HCI UART port. They are controlled directly by the USB to Dual UART Bridge. The red LED (D2) will flash each time a character is transmitted from the UART Bridge to the A20737 module, while the green LED (D4) will flash each time a character is received from the A20737 module.

- **Peripheral UART LEDs (D3, D5)**

  These LEDs indicate activity on the Peripheral UART port. They are controlled directly by the USB to Dual UART Bridge. The red LED (D5) will flash each time a character is transmitted from the UART Bridge to the A20737 module, while the green LED (D3) will flash each time a character is received from the A20737 module.

- **USB Power LED (D6)**

  The USB power LED indicates the presence of +5V, whether supplied via the USB connector or J3, and is powered from the onboard 3.3V LDO. Please note that if the USB/Battery Power Switch (S5) is set to 'Battery' and +5V is applied to the board, the LED will be ON but the A20737 module and sensors will not be powered.

- **Buzzer (LS1)**

  The piezoelectric buzzer is specified for 1kHz to 6kHz operation (4kHz nominal) and should be driven with a 50% duty cycle square wave. The drive signal is connected to port P14 (PWM2) of the A20737 module.

3.2.5. GPIO Expander (U6)

The Exar XRA1201P GPIO Expander (I^2C) is a 16-bit device which adds additional I/O for use by a microcontroller with limited pin count. On the MSDB, the primary role of the GPIO expander is to funnel all interrupts from the various devices on the board into a single pin on the A20737 module. Please refer to the XRA1201 datasheet on the Exar website for further info regarding this device.

The I^2C bus address of this device is 0x21.

3.2.6. USB to Dual UART Bridge (U10)

The FTDI FT2232H is a USB 2.0 high speed (480mb/s) to dual multipurpose UART/FIFO. Port A connects to the HCI interface on the A20737 and is used for programming the module's onboard EEPROM with the application firmware. Port B connects to the peripheral UART on the A20737 and may be used to send data between the application firmware and a PC/laptop. Please refer to the FT2232H datasheet on the FTDI website for further info regarding this device.

3.2.7. Voltage Regulators

- **3.3V LDO (U14)**

The Texas Instruments TPS73433 is a 3.3V 250mA low-dropout linear regulator with low quiescent current, ultra-low noise, and high PSRR. This regulator is powered by +5V which is supplied to the MSDB either from the USB connector or via J3. It supplies power to the USB to Dual UART Bridge circuitry, as well as to the rest of the board when the USB/Battery Power Switch is set to 'USB'.

- **2.1V DC-DC Converter (U9)**

The Texas Instruments TPS62730 is a 100mA step down converter with bypass mode and is intended for ultra-low power wireless applications. In bypass mode, the converter stops switching and passes its input supply to the output. While switching is enabled, the converter outputs a regulated 2.1 volts.

To conserve power the converter is typically turned ON (switching enabled) during high current operation, for example during radio transmit or receive operations. While the load is placed in a low-power sleep state, the converter switching is stopped by placing the device in bypass mode such that the quiescent current is minimized (30nA typ).

By default the converter is in bypass mode and may be controlled by the firmware (port P0) to enable switching.

3.2.8. Jumpers

- **Current Monitoring (JP1)**

  This jumper allows the board current to be measured with an external ammeter/multi-meter connected to J1-14 and J1-15. It is a surface mount resistor footprint (0603) with a trace connecting the two terminals. For current measurements using an external meter, the trace must be cut. To return the board back to a functional state without the meter, a zero Ohm resistor should be soldered across the JP1 terminals. Optionally, a jumper wire may be soldered across J1 pins 14 & 15.

- **Voltage/Photodiode Select (R5)**

  This jumper selects whether port P15 on the A20737 module is connected to the onboard voltage divider or photodiode. It is a 3-terminal footprint which accepts a 0603 resistor in one of two positions. By default, the voltage divider is connected to P15. To use the onboard photodiode, the zero Ohm resistor installed in position 2-C should be moved to position 1-C.

- **LED/Crystal Select (R77, R78)**

  These jumpers select whether ports P11/27 and P12/26 on the A20737 module are connected to the onboard 32kHz crystal or RGB LED. Each is a 3-terminal footprint which accepts a 0603 resistor in one of two positions. By default, the RGB LED is connected to the A20737. To use the onboard crystal, the zero Ohm resistors installed in position 1-C should be moved to position 2-C.

3.2.9. Connectors

- **Coin Cell Battery Holder (BT1)**

  The battery holder is located on the back side of the board and accepts a standard CR2032 lithium coin cell. When installing a battery, be sure the positive (+) side is facing outward. Inserting the battery upside down creates a short circuit between the battery holder (+) and (-) terminals, however this will not damage the MSDB or the battery provided there are no other voltage sources connected to VDD.

- **Micro USB Connector (J4)**

  This USB 2.0 compliant micro-B connector provides a USB connection to the MSDB. In addition to providing power to the board, the USB signals directly interface with a Dual UART Bridge used for programming the A20737 module as well as for communication with the peripheral UART port on the A20737.

- **J1 – HCI UART, I²C, Reset, Buzzer, and Interrupt Interfaces**

Table 4 – J1 Pinout

Pin # (Label)	Schematic Signal Name	Description	SWD	I²C
J1-1 (P15)	P15_VOLTAGE_IRRX	Voltage on this pin is 0.25 x VDDIO (10k to GND, 30K to VDDIO). An external voltage may be applied and measured using the A20737 module's ADC. Moving the position of R5 from 2-C to 1-C connects the photodiode to the A20737 module. Alternatively, R5 can be removed and an external photodiode may be connected to this pin.		
J1-2 (GND)	GND	Common Ground	X	
J1-3 (HCIRX)	HCI_RX	HCI UART RxD – Serial data input for the HCI UART interface. A20737 module has a 10kΩ internal pull down resistor. SWDIO – Serial Wire Debug bidirectional data line.	X	
J1-4 (HCITX)	HCI_TX	HCI UART TxD – Serial data output for the HCI UART interface. SWDCLK – Serial Wire Debug clock.	X	
J1-5 (VDDIO)	VDDIO	SWD Target Power - Supply voltage output for powering buffers in an external JTAG/SWD probe. I²C Power – Supply voltage output for powering external I²C devices. Max load current of external devices should be limited to 25mA for all VDDIO pins.	X	X
J1-6 (SDA)	SDA	I²C bidirectional data line (open-drain).		X
J1-7 (SCL)	SCL	I²C clock (open-drain).		X
J1-8 (GND)	GND	Common Ground		X
J1-9 (TMC)	TMC	A20737 module has a 10kΩ internal pull down resistor. For factory test only. Leave unconnected.		

Pin # (Label)	Schematic Signal Name	Description	SWD	I^2C
J1-10 (RST#)	RESET#	A20737 module hardware reset. Active-low.		
J1-11 (P0)	P0_BYPASS	DC-DC converter control. May be controlled externally if A20737 module firmware configures P0 pin as high-impedance input. 0 = Bypass (VDDIO = VDD) 1= Switching (VDDIO = 2.1V)		
J1-12 (P14)	P14/P38_BUZZER	Buzzer drive signal. May be controlled externally if A20737 module firmware configures P14 pin as high-impedance input. Must be 50% duty cycle.		
J1-13 (P2)	P2_INT_GPIO#	Active-low interrupt signal (open-drain)		
J1-14 (VDD)	VDD	DC-DC converter supply voltage. May also be used to connect an external ammeter/multi-meter (along with J1-15 if trace between JP1 terminals is cut)		
J1-15 (IN-)	IN--	Current Sense Amplifier negative input terminal. May also be used to connect an external ammeter/multi-meter (along with J1-14 if trace between JP1 terminals is cut)		
J1-16 (IOUT)	IOUT	Current Sense Amplifier analog output. The amplifier has a gain of 50x. With the 0.2 Ohm shunt resistor, current is calculated by simply dividing the voltage at this pin by 10 (I = V / 10).		

- **J2 – RGB LED, SPI, and PUART Interfaces**

Table 5 – J2 Pinout

Pin # (Label)	Schematic Signal Name	Description	SPI	PUART
J2-1 (GND)	GND	Common Ground		
J2-2 (VRF)	VDD_RF	Supply for RF circuitry. Connected to LDO_OUT (1.2V) by default.		
J2-3 (P11)	P11/P27_LED-G	LED drive signal for Green segment of tri-color LED. May also be used as general purpose I/O: GPIO: P12 GPIO: P26 This pin and J2-4 also share the connections for a 32kHz crystal (Y1). To use the crystal, move the position of R77 from 1-C to 2-C. R78 must also be moved.		
J2-4 (P12)	P12/P27_LED-R	LED drive signal for Red segment of tri-color LED. May also be used as general purpose I/O: GPIO: P11 GPIO: P27 This pin and J2-3 also share the connections for a 32kHz crystal (Y1). To use the crystal, move the position of R78 from 1-C to 2-C. R77 must also be moved.		
J2-5 (P13)	P13/P28_LED-B_IRTX	LED drive signal for Blue segment of tri-color LED and IR Emitter. May also be used as general purpose I/O: GPIO: P13 GPIO: P28 Please note that the IR Emitter is active when the Blue segment of the tri-color LED is ON.		

Pin # (Label)	Schematic Signal Name	Description	SPI	PUART
J2-6 (VDDIO)	VDDIO	SPI Power – Supply voltage output for powering external SPI devices. Max load current of external devices should be limited to 25mA for all VDDIO pins.	X	
J2-7 (GND)	GND	Common Ground	X	
J2-8 (P24)	P24_SPI_SCLK	SPI clock signal. May also be used as general purpose I/O if SPI functionality not required: GPIO: P24	X	
J2-9 (P25)	P25_SPI_MOSI	SPI data signal (master to slave). May also be used as general purpose I/O if SPI functionality not required: GPIO: P25	X	
J2-10 (P4)	P4_SPI_MISO	SPI data signal (slave to master). May also be used as general purpose I/O if SPI functionality not required: GPIO: P4	X	
J2-11 (P3)	P3_SPI_CS_PUART_CTS	SPI slave select for the onboard accelerometer. Active-low. May also be used for peripheral UART hardware flow control CTS signal. Note that using CTS will activate the accelerometer MISO output. It is recommended to hold SPI SCLK low if using this pin for CTS. May also be used as general purpose I/O if SPI and PUART flow control not required: GPIO: P3	X	X

Pin # (Label)	Schematic Signal Name	Description	SPI	PUART
J2-12 (P1)	P1_EEPROM_PUART_RTS	A20737 module EEPROM write control. 0 = EEPROM is writeable 1 = EEPROM is write protected May also be used for peripheral UART hardware flow control RTS signal (not recommended).		X
J2-13 (P32)	P32_PUART_TX	Peripheral UART TxD output. May also be used as general purpose I/O if PUART functionality not required: GPIO: P32		X
J2-14 (P8)	P8/P33_PUART_RX	Peripheral UART RxD input. May also be used as general purpose I/O if PUART functionality not required: GPIO: P8 GPIO: P33		X
J2-15 (GND)	GND	Common Ground		X
J2-16 (VDDIO)	VDDIO	UART Power – Supply voltage output for powering external UART devices. Max load current of external devices should be limited to 25mA for all VDDIO pins.		X

- **J3 – USB +5V Interface**

Table 6 – J3 Pinout

Pin # (Label)	Schematic Signal Name	Description
J3-1 (GND)	GND	Common Ground
J3-2 (5V)	V5_USB	+5V output when the board is powered via USB. May also be used as +5V input to power the board if there is no USB cable connected.

3.3. Schematics

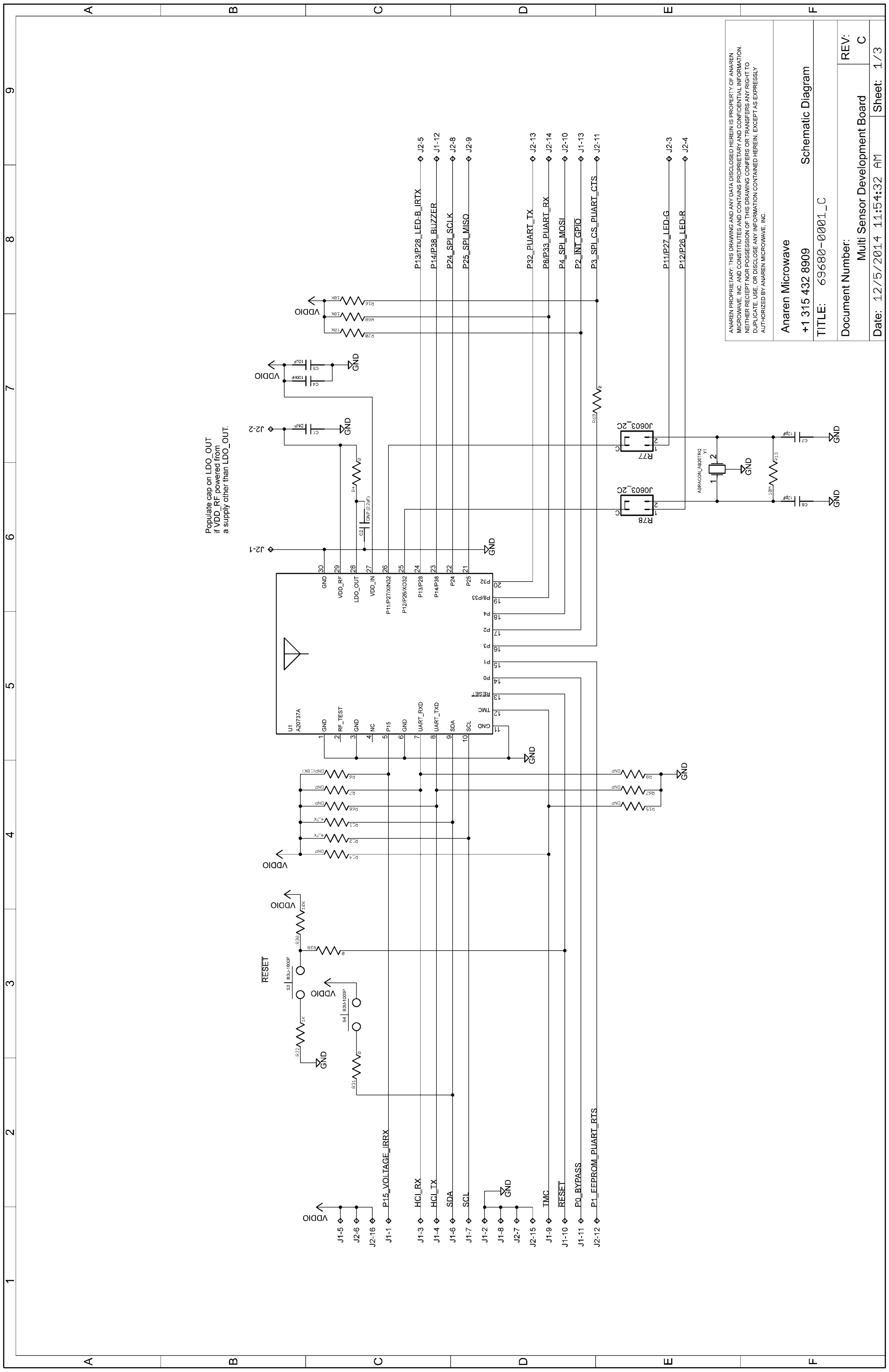


Figure 5 – Schematic Sheet 1

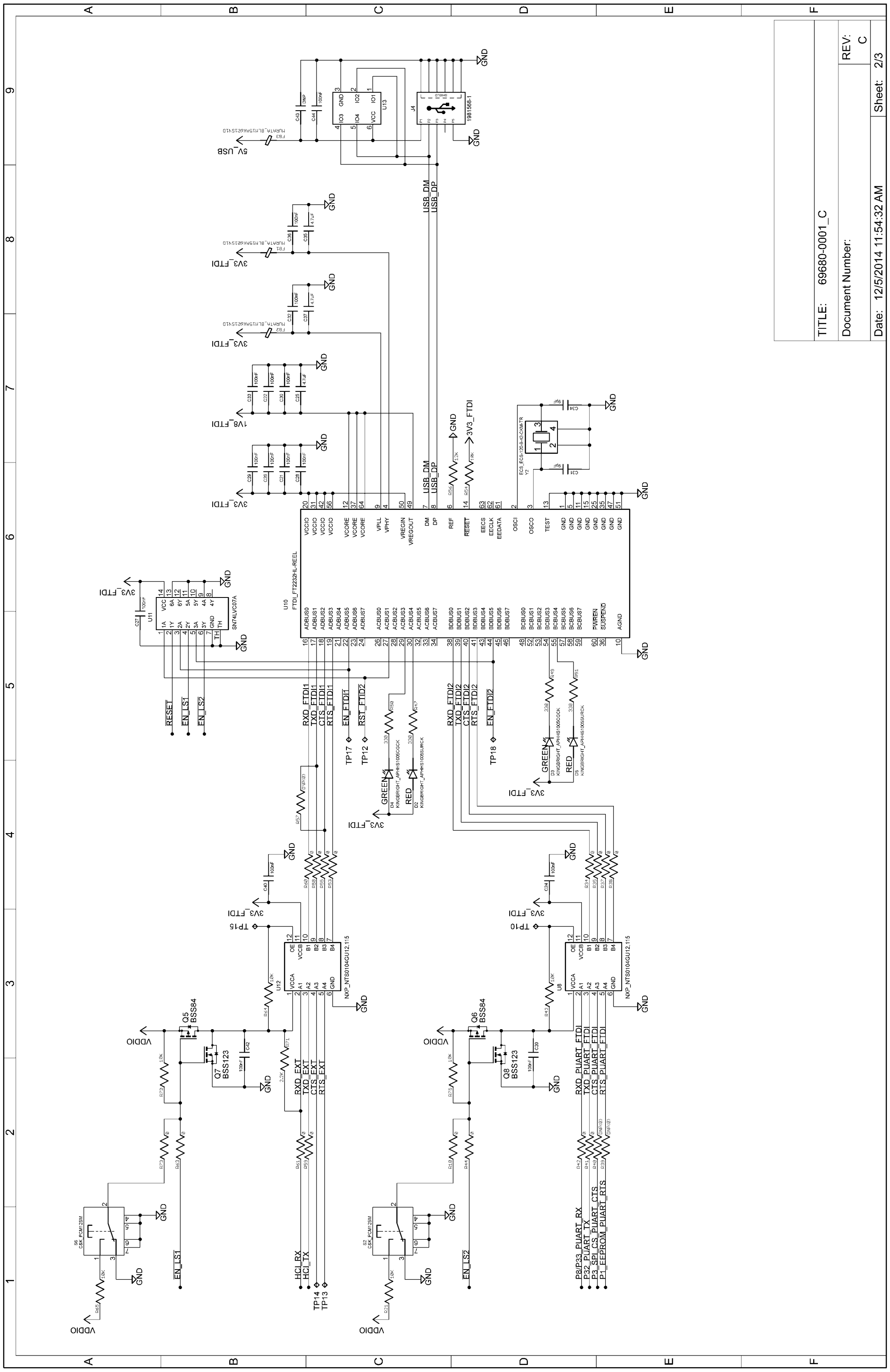


Figure 6 – Schematic Sheet 2

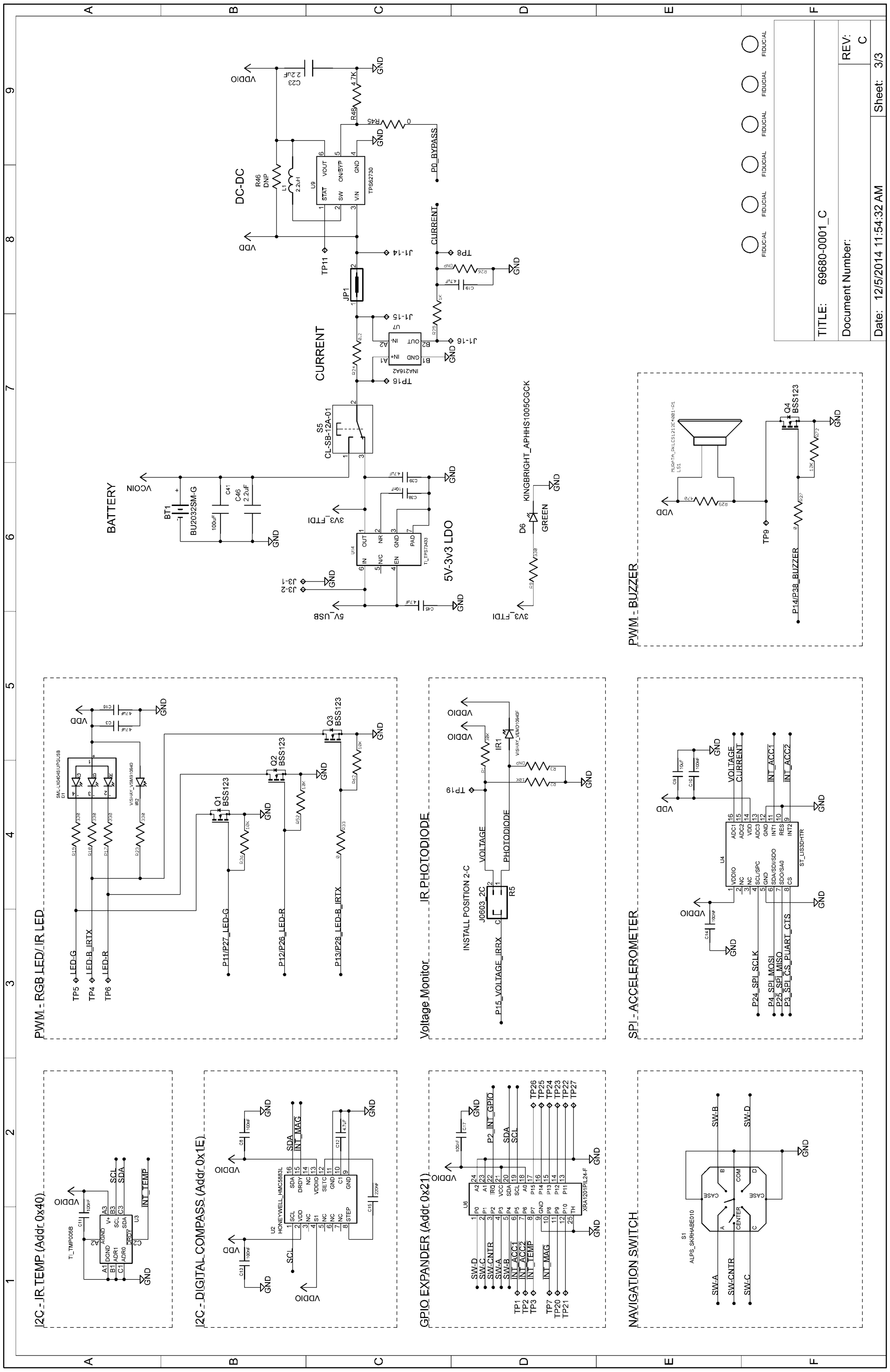


Figure 7 – Schematic Sheet 3

3.4. PCB Layout

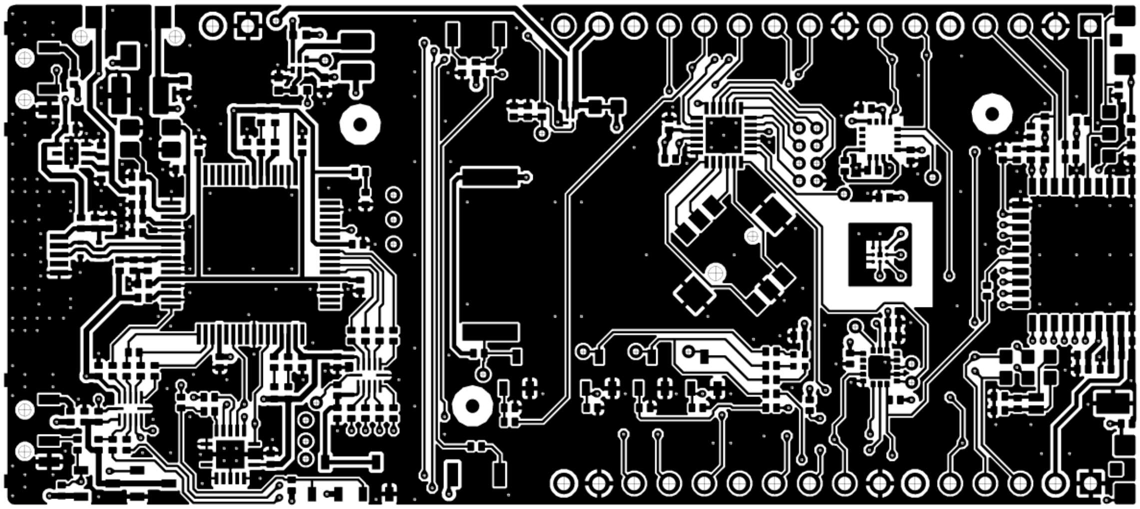


Figure 8 – PCB Layout Top Layer

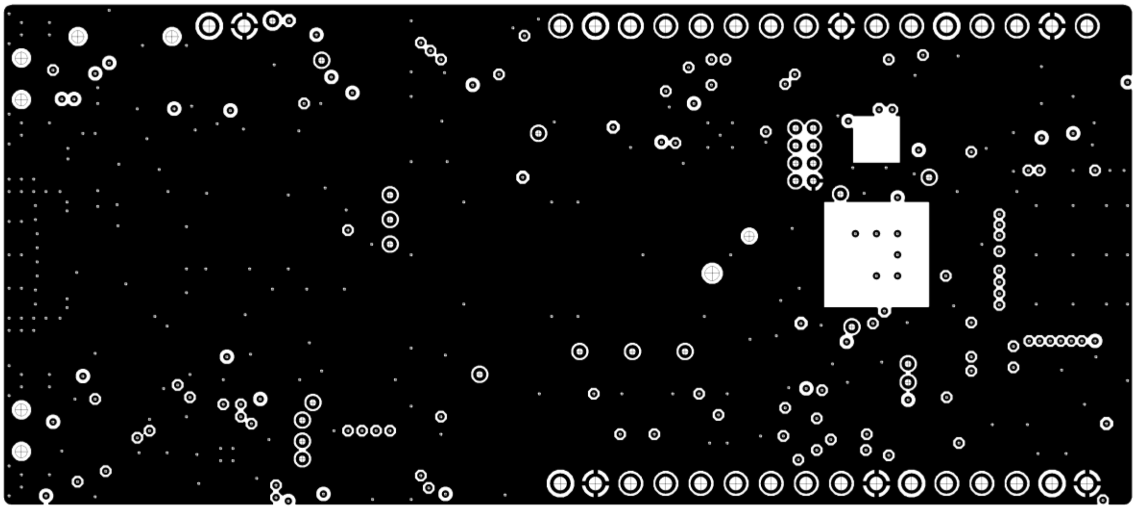


Figure 9 – PCB Layout Inner Layer (GND Plane)

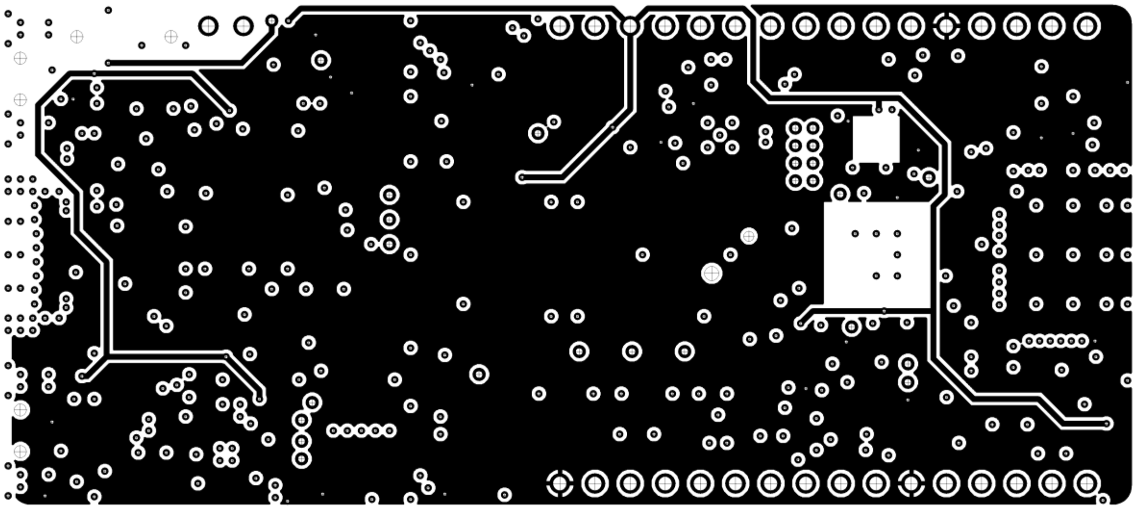


Figure 10 – PCB Layout Inner Layer (Split PWR Plane)

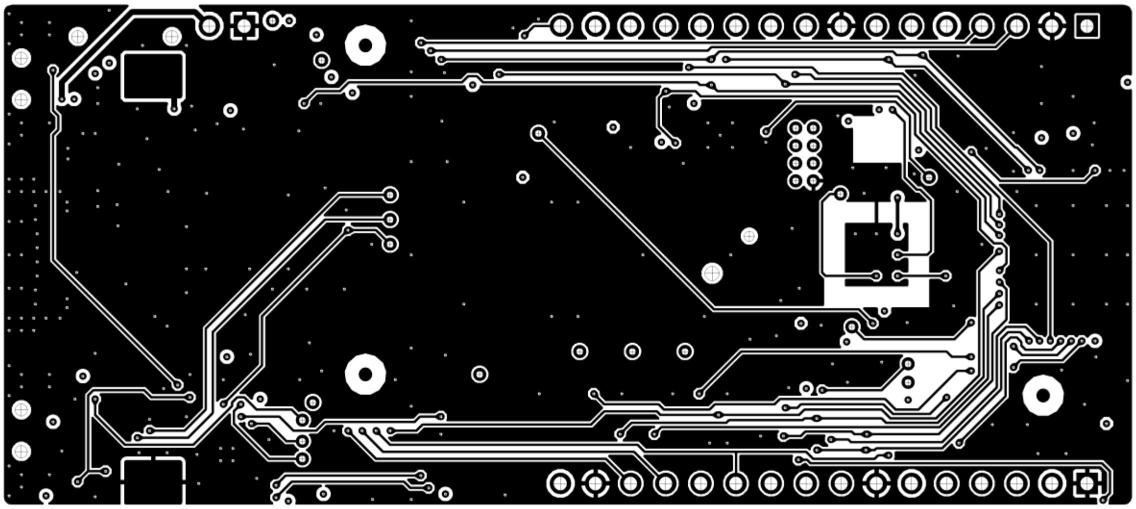


Figure 11 – PCB Layout Bottom Layer

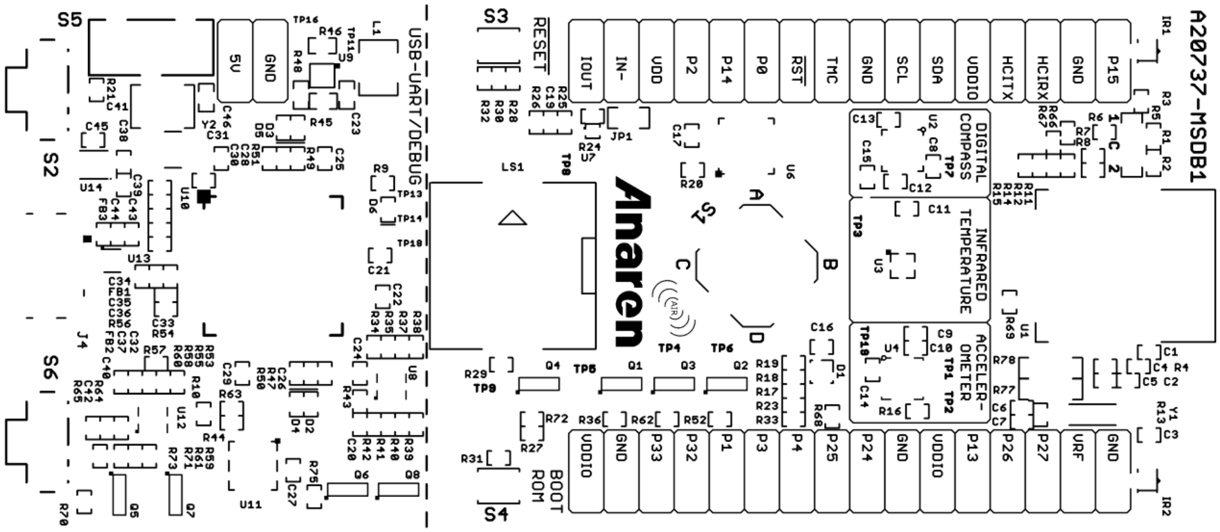


Figure 12 –PCB Layout Top Silkscreen

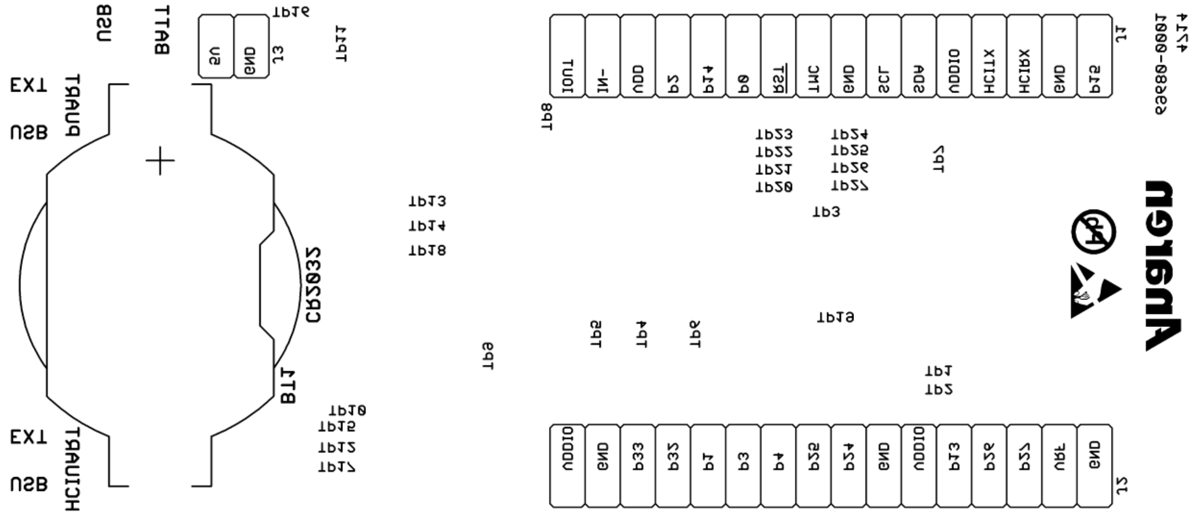


Figure 13 –PCB Layout Bottom Silkscreen

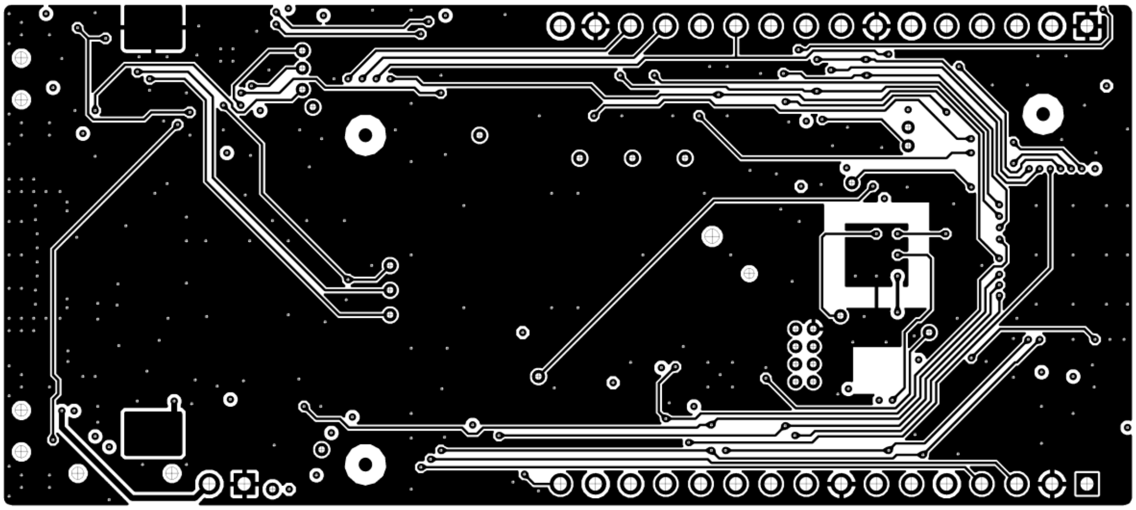


Figure 14 –PCB Layout Bottom Layer Mirror Image

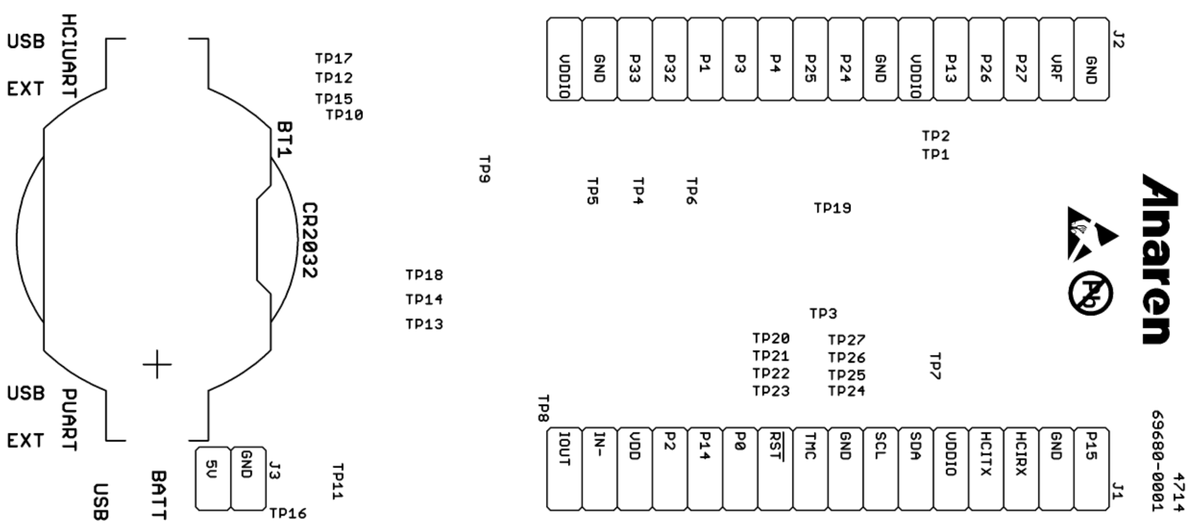


Figure 15 –PCB Layout Bottom Silkscreen Mirror Image

3.5. Bill of Materials (BOM)

Table 7 – Bill of Materials

Item	Ref Des	Qty	Description	Comment
0001	BT1	1	HOLDER BATTERY 20MM COIN	
0002	C1, C2, C43	0		Not Populated
0003	C15	1	CAP CER 0.22UF 6.3V 10% X7R 0402	
0004	C23, C46	2	CAP CER 2.2UF 6.3V 10% X5R 0402	
0005	C3, C12, C16, C19, C25, C35, C37, C39, C45	9	CAP CER 4.7UF 6.3V 20% X5R 0402	
0006	C31, C34	2	CAP CER 9PF 50V NP0 0402	
0007	C38	1	CAP CER 10000PF 16V 10% X7R 0402	
0008	C4, C8, C10, C11, C13, C14, C17, C20, C21, C22, C24, C26, C27, C28, C29, C30, C32, C33, C36, C40, C42, C44	22	CAP CER 0.1UF 10V 10% X5R 0402	
0009	C41	1	CAP CER 100UF 6.3V 20% X5R 1210	
0010	C5, C9	2	CAP CER 10UF 6.3V 20% X5R 0402	
0011	C6, C7	2	CAP CER 12PF 50V 1% NP0 0402	
0012	D1	1	LED RGB SQUARE CLEAR SMD	Lumex SML-LX0404SIUPGUSB
0013	D2, D5	2	LED 1X0.5MM 630NM RD WTR CLR SMD	Kingbright APHHS1005SURCK
0014	D3, D4, D6	3	LED 1X0.5MM 570NM GN WTR CLR SMD	Kingbright APHHS1005CGCK
0015	FB1, FB2, FB3	3	FERRITE CHIP 600 OHM 0402	
0016	IR1	1	PHOTODIODE SILICON PIN SMD	Vishay VEMD10940F
0017	IR2	1	IR EMITTER 940NM HIGH SPEED SMD	Vishay VSMB10940
0018	J1, J2	0	CONN HEADER .100" SNGL STR 16POS	Not Populated
0019	J3	0	CONN HEADER .100" SNGL STR 2POS	Not Populated
0020	J4	1	CONN RCPT STD MICRO USB TYPE B	

Item	Ref Des	Qty	Description	Comment
0021	JP1	0	RES 0.0 OHM 1/10W JUMP 0603	Not Populated
0022	L1	1	INDUCTOR 2.2UH 1.3A SMD	
0023	LS1	1	BUZZER PIEZO 25VP-P SMD	
0024	Q1, Q2, Q3, Q4, Q7, Q8	6	MOSFET N-CH 100V 170MA SOT-23	
0025	Q5, Q6	2	MOSFET P-CH 50V 130MA SOT-23	
0026	R1	1	RES 30K OHM 1/16W 5% 0402	
0027	R11, R12, R48	3	RES 4.7K OHM 1/16W 5% 0402	
0028	R13	1	RES 10M OHM 1/16W 1% 0402 SMD	
0029	R9, R17, R18, R19, R23, R47, R49, R50, R51	9	RES 330 OHM 1/16W 5% 0402	
0030	R2, R16, R20, R21, R30, R36, R43, R52, R54, R62, R64, R65, R68, R70, R72, R75	16	RES 10.0K OHM 1/16W 5% 0402	
0031	R24	1	RES 0.2 OHM 1/8W 1% 0402	
0032	R25, R32	2	RES 1K OHM 1/16W 5% 0402	
0033	R29	1	RES 470 OHM 1/16W 5% 0402	
0034	R3, R7, R8, R14, R15, R26, R46, R66, R67	0	RES 1/16W 5% 0402	Not Populated
0035	R39, R40, R57	0	RES 0.0 OHM 1/16W JUMP 0402	Not Populated
0036	R4, R10, R27, R28, R31, R33, R34, R35, R37, R38, R41, R42, R44, R45, R53, R55, R58, R59, R60, R61, R63, R69, R73	23	RES 0.0 OHM 1/16W JUMP 0402	
0037	R5, R77, R78	3	RES 0.0 OHM 1/10W JUMP 0603	
0038	R56	1	RES 12K OHM 1/16W 1% 0402	
0039	R6	0	RES 10.0K OHM 1/16W 5% 0402	Not Populated
0040	R71	1	RES 2.2K OHM 1/16W 1% 0402	

Item	Ref Des	Qty	Description	Comment
0041	S1	1	Multi-Directional Switch	
0042	S2, S6	2	SW SLIDE SP2T 6VDC 0.3A SMT	
0043	S3, S4	2	SWITCH TACTILE SPST-NO 0.05A 12V	
0044	S5	1	SWITCH SLIDE SPDT 0.2A JLEAD	
0045	U1	1	Radio Module A20737 SMD	Anaren A20737A
0046	U10	1	IC USB HS DUAL UART/FIFO 64-LQFP	FTDI FT2232HL-REEL
0047	U11	1	IC BUFF/DVR HEX NON-INV 14VQFN	Texas Instruments SN74LVC07ARGYR
0048	U13	1	TVS DIODE 5.5VWM 6USON	Texas Instruments TPD4E001DPKR
0049	U14	1	IC REG LDO 3.3V 0.25A 6SON	Texas Instruments TPS73433DRVR
0050	U2	1	IC COMPASS 3 AXIS I2C 16LCC SMD	Honeywell HMC5883L-TR
0051	U3	1	IC TEMP THERMOPILE 8DSBGA	Texas Instruments TMP006BIYZFT
0052	U4	1	ACCELEROMETER 3AXIS MEMS 16-LGA	ST Microelectronics LIS3DHTR
0053	U6	1	IC I/O EXPANDER I2C 16B 24QFN	Exar XRA1201PIL24-F
0054	U7	1	IC CURRENT SHUNT MONITOR 4DSBGA	Texas Instruments INA216A2YFFR
0055	U8, U12	2	IC TRANSLATING TXRX 12XQFN	NXP NTS0104GU12,115
0056	U9	1	IC DCDC CONV STP-DN SYNC LP 6SON	Texas Instruments TPS62730DRYT
0057	Y1	1	CRYSTAL 32.768KHZ 12.5PF SMD	Abracon AB26TRQ-32.768KHZ-T
0058	Y2	1	CRYSTAL 12MHZ 9PF SMD	ECS ECS-120-9-42-CKM-TR

HISTORY

Date	Author	Change Note No./Notes
1/9/2015		Initial Draft
1/16/2015		Initial Release

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